

being due to gun-firing, four to explosions of dynamite or gunpowder, and the remainder to volcanic explosions in Japan.<sup>2</sup>

The source of sound is always unsymmetrically placed within the inner sound area, and nearly always lies on the side facing the outer sound area. On this side the boundary of the inner area may be as near as  $2\frac{1}{2}$  miles, or as distant as 39 miles, from the source. The most important dimension, however, is the radius or mean radius of the curve that forms the outer boundary of the zone of silence. It is far from being constant. It may be as low as 50 miles, as in the case of the minute-guns fired at Spithead on February 1, 1901, or as high as 99 miles, as with the Wiener-Neustadt explosion of 1912. \* \* \*

Though later accounts may modify some of the dimensions given below, a first analysis of the reports already received shows that the explosion at East London on January 19, 1917, belongs to the class with double sound areas. *The inner sound area* is of unusual form, being L-shaped with the angle near Godalming, the east-west limb reaching to Canterbury, and the north-south limb reaching to the neighborhood of Northampton. The least distance of the boundary of the inner area from the source of sound is about 12 miles, and the greatest distance is 65 miles.

*The outer sound area* lies to the north of the other, with its center a few miles west of King's Lynn. Its longer axis, 131 miles in length, reaches from the neighborhood of Nottingham to that of Lowestoft and is about 55 miles in width. *The zone of silence* varies in width from 16 miles (near Northampton) to 54 miles, and the distance of its outer boundary from the source is about 60 miles. So far as is known at present it includes the greater part of Essex and Suffolk, the southern half of the counties of Cambridge and Huntingdon, and the central portion of Northamptonshire. Even if observations should be received afterwards from this area, it is significant that from the inner sound area of about 3,500 square miles there have so far been received 250 records in which the time is given, from the outer sound area of about 5,700 square miles 223 records (including 122 from Norfolk and 56 from Lincolnshire), and from the zone of silence

of about 4,500 square miles only one record and that one close to the sea. The greatest distance to which the sound waves penetrated is about 121 miles.

A remarkable feature about these records is that, although all have been sent in reply to my newspaper letters (and therefore sent as it were at random), they are almost as thickly grouped near the boundaries as near the centers of the two areas. There is none of that increasing sparseness of records near the boundary which is so characteristic of earthquake investigations. It would seem as if the boundary were determined, not by the sound vibrations becoming inaudible, but by the absence of sound vibrations from the area beyond. It may be of interest to add that, at a large number of places, pheasants showed signs of alarm as they did during the North Sea battle of January 24, 1915. \* \* \*

#### PARHELIC CIRCLE WITH TWO PAIRS OF PARHELIA AT FARGO, N. DAK.

C. L. Meller, writing to the Scientific American (issue for Mar. 24, 1917, p. 305) from Fargo, N. Dak., reports the occurrence at that place on December 28, 1916, of a complete parhelic circle accompanied by the colored parhelia of  $22^\circ(?)$  and also by what appear to have been the faintly colored parhelia of  $46^\circ$ . The essential portions of his description follow:

It was Thursday noon, the weather a few degrees above  $0^\circ\text{F.}$ , \* \* \* the thermometer began to drop \* \* \*. At each side of the sun a sun dog stood, a condensed little rainbow with the red toward the sun, showing but little curvature and not a great many times longer than it was wide, with no great width at that. \* \* \* A narrow band of light, readily visible, still not without a certain quality of faintness, \* \* \* stretched from one sun dog to the other, not overhead but to the north, and no higher than the sun stood to the south. Twice the distance that each sun dog was from the sun this ring of light widened into an irregular disk of light that seemed each a second sun dog with the colors so faint that the eye could only discern them as a faint white light. \* \* \* The sun dogs rose with the sun and stood with the sun until 3 o'clock in the afternoon, but the ring lasted only from about 11 till a little past noon.

It is unfortunate that the observer did not determine the angular positions of these parhelia on the parhelic circle; and it would also be interesting to know if the anthelion certainly did not form on this occasion.—C. A. jr.

<sup>2</sup> Fujihara, S. On the abnormal propagation of sound waves in the atmosphere. Abstracted in MONTHLY WEATHER REVIEW, May, 1914, 42:258-265 [bibliography], and August, 1916, 44:436-439 [Illustr.].